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Patent Counsel
Applied Materials, Inc.
P.O. Box 450-A
Santa Clara, CA 95052

EXAMINER

STOUFFER, KELLY M

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1762

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.



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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/965,370
Filing Date: September 26, 2001
Appellant(s): CHUNG ET AL.

Keith M. Tackett
For Appellant

SUPPLEMENTAL EXAMINER'S ANSWER

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Responsive to the reply brief filed on 22 March 2007, a supplemental Examiner's Answer is set forth below:

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the appeal brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The appeal of the final rejections of claims 1-7, 9-31, 33-41, 53-59, 63, and 67-69 under 35 USC 103(a) over Lopatin et al. (US 6368954) in view of Lopatin et al. (US 6174799) and claims 31, 32, 53-59, 63, and 67-69 under 35 USC 103(a) over Lopatin et al. (US 6368954) in view of Lopatin et al. (US 6174799) and in further view of Tsai et al. (US 6309964) was withdrawn in the reply brief filed 22 March 2007. The 35 USC 103(a) rejections of claims 42, 44-52 and 60-62 over Lopatin et al. (US 6368954) in view of Lopatin et al. (US 6174799) and in further view of Kobaybashi et al. (US 5023698) and claims 42, 44-52, 60-62 and 64-66 over Lopatin et al. (US 6368954) in view of Lopatin et al. (US 6174799) and in further view of Tsai et al. (US 6309964) and Kobaybashi et al. (US 5023698) is appealed.

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(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,368,954	LOPATIN ET AL.	04-2002
6,174,799	LOPATIN ET AL.	01-2001
6,309,964	TSAI ET AL.	10-2001
5,023,698	KOBAYASHI ET AL.	06-1991

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 42, 44-52, and 60-62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (US Patent number 6368954) in view of Lopatin et al. (US Patent number 6174799) as applied above, and further in view of Kobayashi et al. (US Patent number 5023698).

Lopatin ('954) teaches a process of forming a barrier layer of tantalum, tungsten, or titanium, and nitrides or silicides thereof (column 5, lines 19-25). The barrier layer is formed by ALD to a thickness of 20-300 angstroms (column 5, lines 29-31). It is the position of the examiner that 20.000001 is "about 20 angstroms" and since 20 is less than 20.0000001, the reference anticipates "less than about 20 angstroms." Two copper seed layers are taught and are formed by ALE or CVD (column 5, line 40 - column 6, line 54). The bulk copper layer is deposited by CVD (column 6, lines 55-67). The reference is silent to the seed layer comprising other metals besides copper.

However, Lopatin ('799) teaches that copper seed layers alloyed with aluminum or magnesium decreases electro-migration (abstract; column 3, lines 1-15). A nitrogen grading is additionally responsible for increased adhesion (abstract; column 3, lines 1-15). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use the constituents of the seed layer of Lopatin ('799) in the process taught by Lopatin ('954). By doing so, one would reap the benefits of the bulk copper layer having better adhesion to the barrier layer and decreased electro-migration.

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Lopatin et al. ('799) includes a desire to reduce electro-migration by adding another metal such as aluminum in the copper seed layer (column 2 lines 34-38 and column 3 lines 7-10). The two references do not include claimed atomic ratios of aluminum contained in the copper layer. Kobayashi et al. teaches that providing Al in the claimed atomic ratios (when calculated from the weight percentages using atomic weights) in an alloy with copper improves electro-migration resistance in a wiring layer, hence it would be obvious to use the claimed ratios of Al in the CuAl seed layer with a reasonable expectation of reducing electro-migration. (column 3 lines 50-59 and column 4 lines 1-14).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Lopatin et al. (US Patent number 6368954) and Lopatin et al. (US Patent number 6174799) to include the claimed atomic ratios for aluminum in the copper layer as taught by Kobayashi et al. in order to improve electro-migration resistance.

Claims 42, 44-52, 60-62 and 64-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (US 6,368,954 B1) in view of Lopatin et al. (US 6,174,799 B1), as applied to the claims above, and further in view of Tsai et al. (US 6,309,964 B1) and Kobayashi et al. (US Patent number 5023698).

Lopatin, in view of Lopatin, teach the limitations above. In the event the applicant does not agree with the examiner's position that 20 angstroms reads on "less than about 20 angstroms", the examiner has provided Tsai. Tsai teaches barrier layers of

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the same material being effective at a thickness of 10 angstroms (column 3, lines 40-46). It would be apparent to one of ordinary skill that this would use less material and/or would decrease the size of the semiconductor. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use a thickness of 10 angstroms for the barrier layer in the process taught by Lopatin. By doing so, one would reap the benefits of using less material and/or creating a smaller semiconductor, while still producing an effective barrier layer.

Lopatin et al. (US Patent number 6368954), Lopatin et al. (US Patent number 6174799), and Tsai et al. do not include the claimed atomic ratios of aluminum contained in the copper layer. Kobayashi et al. teaches using the claimed atomic ratios (when calculated from the weight percentages using atomic weights) to improve electro-migration resistance (column 3 lines 50-59 and column 4 lines 1-14).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Lopatin et al. (US Patent number 6368954), Lopatin et al. (US Patent number 6174799), and Tsai et al. to include the claimed atomic ratios for aluminum in the copper layer as taught by Kobayashi et al. in order to improve electro-migration resistance.

(10) Response to Argument

The applicant's arguments regarding the 35 USC 103(a) rejection of claims 42, 44-52, and 60-62 over Lopatin et al. (US Patent number 6368954) in view of Lopatin et al. (US Patent number 6174799) as applied above, and further in view of Kobayashi et al. (US Patent number 5023698) are not convincing.

The applicant argues that Kobayashi et al. does not teach that adding the trace amounts of the metal element to the copper metallization layer increases the adhesion of the metallization layer to an underlying layer. However, as is discussed above, Lopatin et al. ('799) includes a desire to reduce electro-migration by adding another metal such as aluminum in the copper seed layer (column 2 lines 34-38 and column 3 lines 7-10). Kobayashi et al. teaches that providing Al in the claimed atomic ratios (when calculated from the weight percentages using atomic weights) in an alloy with copper improves electro-migration resistance in a wiring layer, hence it would be obvious to use the claimed ratios of Al in the CuAl seed layer with a reasonable expectation of reducing electro-migration. (column 3 lines 50-59 and column 4 lines 1-14). Therefore, one of ordinary skill in the art would be motivated to combine these references to reduce electro-migration by using the claimed ratios. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). The applicant further argues, that because of this, the references do not teach the limitations in the claims, which it is the examiner's position that the limitations are taught as is discussed above in section 9. The recitation of "filling a feature" has not been given patentable weight because the recitation occurs in the preamble. A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on the preamble for completeness but, instead, the process

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steps or structural limitations are able to stand alone. See *In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951).

The applicant's arguments regarding the 35 USC 103(a) rejection of claims 42, 44-52, 60-62 and 64-66 over Lopatin et al. (US Patent number 6368954) in view of Lopatin et al. (US Patent number 6174799) as applied above, and further in view of Tsai et al. (US Patent number 6309964) and Kobayashi et al. (US Patent number 5023698) are not convincing for the same reasons discussed above.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Appellant may file another reply brief in compliance with 37 CFR 41.41 within two months of the date of mailing of this supplemental examiner's answer. Extensions of time under 37 CFR 1.136(a) are not applicable to this two month time period. See 37 CFR 41.43(b)-(c).

Respectfully submitted,

Kelly M. Stouffer


A Technology Center Director or designee has approved this supplemental examiner's answer by signing below:


GREGORY MILLS
QUALITY ASSURANCE SPECIALIST

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Conferees:

Timothy Meeks



TIMOTHY MEEKS
SUPERVISORY PATENT EXAMINER



JENNIFER MICHENER
QUALITY ASSURANCE SPECIALIST